Claims

What is claimed:

1. An in-vessel or down-hole imaging sensor, comprising

means adapted to selectively emit and/or detect two or more independently controllable wavelengths or wavebands.

2. The sensor of claim 1, wherein

the independently controllable wavelengths or wavebands render the media in the field of view opaque or transparent.

3. The sensor of claim 1, wherein

the independently controllable wavelengths or wavebands excite fluorescence, thereby revealing the presence of one or more medium or component in a media.

4. A method of obtaining images in a vessel, comprising

operating a sensor and illuminating means to selectively emit and/or detect radiation of two or more independently controllable wavelengths or wavebands.

5. An in-vessel or down-hole imaging sensor, comprising

a sensor window;

illuminating means for emitting radiation;

optical means for directing said radiation through an area of said sensor window in a first direction; and

optical means for receiving radiation reflected from a target illuminated by radiation from said illuminating means through said area of said sensor window in a second direction.

6. The imaging sensor of claim 5, further comprising

an imaging detector and associated electronics and mechanical housing; and

an illuminator.

7. The imaging sensor of claim 6, further comprising

a common-path optic which forms said sensor window for both emitted and received radiation.

8. The sensor of claim 6, wherein

said detector comprises a vacuum tube device that is sensitive to visible and near infrared radiation.

9. The sensor of claim 6, further comprising

cooling or temperature control means for stabilising or lowering the temperature of said detector.

10. The sensor of claim 6, further comprising

means for focussing incoming energy onto said detector.

11. The sensor of claim 10,

wherein said focussing means comprise anti-reflection coatings.

12. The sensor of claim 11, wherein

said focussing means map a scene onto the detector.

13. The sensor of claim 11, wherein

fiducial marks are incorporated into images.

14. The sensor of claim 13, wherein

said fiducial marks are placed in a scene viewed by said detector.

15. The sensor of claim 13, wherein

said fiducial marks are added electronically.

16. The sensor of claim 6, wherein

said illuminator comprises one or more sources selected to match the spectral transmission of media in which the image sensor is used.

17. The sensor of claim 16, wherein

said sources are laser diodes.

18. The sensor of claim 16,

wherein a broadband source and said detector are used together with mechanically interchanged filters for selecting appropriate wavebands.

19. The sensor of claim 16,

wherein filters whose transmission wavelength or waveband can be altered electrically are used for selecting appropriate wavebands.

20. The sensor of claim 16, wherein said illuminator comprises a plurality of sources, and only one of the sources is energised.

21. The sensor of claim 16, wherein

a mosaic of wavelength selecting filters are applied to individual pixels in an array or line detector and images are obtained by electronic processing of output signals.

22. The sensor of claim 5,

further comprising a prism or prisms for diffraction grating.

23. The sensor of claim 5,

further comprising multiple discrete detectors or a detector array or arrays.

24. The sensor of claim 23,

further comprising a beam splitter or beam splitters and relay optics.

25. The sensor of claim 24,

further comprising more than one assembly comprising relay and focussing optics and detector or detectors.

26. The sensor of claim 5,

further comprising polarizing filters.

27. A down-hole or in-vessel imaging apparatus, comprising

illuminating means for emitting radiation of a specified wavelength or waveband through a medium to a target;

detector means for detecting radiation deflected by said target; and

amplifier means for providing non-linear amplification of the detector means output.

28. The sensor of claim 27, wherein

said amplifier is a video amplifier with a non-linear response.

29. The sensor of claim 27, further comprising

a selectable wavelength or waveband system, comprising different amplifiers for different media; and

means for selecting between said amplifiers.

30. The sensor of claim 27, further comprising

means for varying a non-linear function of said output.

31. The sensor of claim 30, wherein said means for varying said non-linear function of said output is a remote control means.

32. The sensor of claim 27, further comprising

means for automatically controlling illumination power.

33. The sensor of claim 27, wherein said illumination means comprises

a single laser diode.

34. The sensor of claim 27, wherein said illumination means comprises

an array of laser diodes assembled into a module or modules installed within an image sensor housing.

35. The sensor of claim 34, further comprising

separate electrical connections to diodes or groups of diodes emitting at different wavelengths.

36. The sensor of claim 27, further comprising

stabilising or temperature control means.

37. The sensor of claim 27, wherein

said illumination means are collimated laser beams.

38. The sensor of claim 27, wherein

said illumination means comprises a broad-band source or sources.

39. The sensor of claim 27, wherein

said illumination means comprises more than one independently controllable broad-band source, each with its own wavelength restricting filter or filters.

40. The sensor of claim 27, further comprising

cylindrical spheric or aspheric lenses in front of said illuminating means.

41. The sensor of claim 27, further comprising

a common-path optic which forms an image sensor window,

wherein said common-path optic transmits the outgoing illumination radiation and the returning radiation through the same window area in contact with surrounding media.

42. The sensor of claim 41, wherein

said common-path optic comprises an assembly of more than one component.

43. The sensor of claim 41, wherein

said common-path optic provides optical power to form all or part of the image sensor focussing optics, the illuminator beam shaping optics and to correct distortion in the optical system.

44. The sensor of claim 27, further comprising

a casing;

wherein said illumination means is provided externally to said casing.

45. The sensor of claim 34, wherein

said sensor further comprises power conditioning for said laser diode array and detector,

an analogue video output, and

control electronics to adjust independently the power output of two or more laser diodes or groups of diodes.

46. The sensor of claim 45, wherein

said output power control is commanded by signals applied to the video output line, decoded within the image sensor.

47. The sensor of claim 45, wherein

signals applied to the video line are used to adjust the characteristics of the non-linear amplifier.

48. The sensor of claim 45, further comprising

internal digitisation and compression of the output signal, and a digital output, with separate command lines.

49. The image sensor of claim 27, wherein

said image sensor is arranged in a cylindrical geometry with a sideways-looking optical system.

50. The image sensor of claim 49, wherein

said sensor housing has a cylindrical profile and

said side view window is curved to match the cylindrical profile of the sensor housing.

51. The image sensor of claim 48, wherein

the sensor housing is arranged in a rectangular geometry.

52. The image sensor of claim 27, wherein

the sensor is arranged with the window at the end of the housing.